

1 CLAIMS:

2 1. A method of forming a conductive adhesive connection
3 comprising:

4 providing a first node;

5 providing a second node;

6 providing a liquid conductive epoxy between the first and second
7 nodes, the liquid conductive epoxy having sufficient conductivity that
8 a 15 mil length sample of the liquid conductive epoxy having cross-
9 sectional dimensions of 50 mil by 2 mil would have a resistance of less
10 than about 100 ohms along its length while having a viscosity of less
11 than about 100,000 cps; and

12 curing the liquid conductive epoxy to form a conductive adhesive
13 connection between the first node and the second node.
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1 2. A method of forming a conductive adhesive connection
2 comprising:

3 providing a first node;

4 providing a second node;

5 providing a liquid conductive epoxy mixture between the first and
6 second nodes, the liquid conductive epoxy mixture comprising a first
7 liquid and a second liquid, the liquid conductive epoxy mixture having
8 sufficient conductivity that a 15 mil length sample of the liquid
9 conductive epoxy having cross-sectional dimensions of 50 mil by 2 mil
10 would have a resistance of less than about 100 ohms along its length
11 between about 10 minutes and about 20 minutes of combining the first
12 and second liquids; and

13 curing the liquid conductive epoxy to form a conductive adhesive
14 connection between the first node and the second node.
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1 3. A method of forming a conductive adhesive connection
2 comprising:

3 providing a first node;

4 providing a second node;

5 providing a liquid conductive epoxy mixture between the first and
6 second nodes, the liquid conductive epoxy mixture comprising a first
7 liquid and a second liquid, the liquid conductive epoxy mixture having
8 sufficient conductivity that a 15 mil length sample of the liquid
9 conductive epoxy having cross-sectional dimensions of 50 mil by 2 mil
10 would have a resistance of less than about 100 ohms along its length
11 in less than or equal to about 30 minutes of combining the first and
12 second liquids; and

13 curing the liquid conductive epoxy to form a conductive adhesive
14 connection between the first node and the second node.
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1 4. A method of forming a conductive adhesive connection
2 comprising:

3 providing a first node;

4 providing a second node;

5 providing a liquid conductive epoxy mixture between the first and
6 second nodes, the liquid conductive epoxy mixture comprising a first
7 liquid and a second liquid, the first liquid comprising a hardener and
8 the second liquid comprising a base epoxy; the liquid conductive epoxy
9 mixture comprising at least one ionic salt, the mixture having a
10 sufficiently high ionic salt concentration that a 15 mil length sample of
11 the liquid conductive epoxy mixture having cross-sectional dimensions of
12 50 mil by 2 mil would have a resistance of less than about 100 ohms
13 along its length in less than or equal to about 30 minutes of combining
14 the first and second liquids; and

15 curing the liquid conductive epoxy to form a conductive adhesive
16 connection between the first node and the second node.

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18 5. The method of claim 4 wherein the liquid epoxy mixture is
19 formed by combining the first and second liquids with a third liquid,
20 the third liquid comprising the ionic salt.
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1 6. The method of claim 4 wherein the liquid epoxy mixture is
2 formed by combining the first and second liquids with a third liquid,
3 the third liquid comprising the ionic salt; and wherein the first, second
4 and third liquids are mixed prior to providing the liquid conductive
5 epoxy mixture between the first and second nodes.

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7 7. The method of claim 4 wherein the first and second liquids
8 are mixed prior to providing the liquid conductive epoxy mixture
9 between the first and second nodes.

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11 8. The method of claim 4 wherein the ionic salt is comprised
12 by the first liquid before combining the first and second liquids.

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14 9. The method of claim 4 wherein the ionic salt is comprised
15 by the second liquid before combining the first and second liquids.

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17 10. The method of claim 4 wherein the ionic salt is comprised
18 by the first and second liquids before combining the first and second
19 liquids.

1 11. The method of claim 4 wherein the ionic salt comprises a
2 lithium salt.

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4 12. The method of claim 4 wherein the ionic salt comprises a
5 lithium imide salt.
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13. A method of forming a conductive adhesive connection comprising:

providing a first node;

providing a second node;

providing a liquid conductive epoxy mixture between the first and second nodes, the liquid conductive epoxy mixture comprising a first liquid and a second liquid, the first liquid comprising a hardener and the second liquid comprising a base epoxy; the liquid conductive epoxy mixture comprising at least one ionic salt; the ionic salt being present in sufficient concentration that a 15 mil length sample of the liquid conductive epoxy mixture having cross-sectional dimensions of 50 mil by 2 mil would have a resistance of less than about 100 ohms along its length in less than or equal to about 30 minutes of combining the first and second liquids while having a viscosity of less than about 100,000 cps; and

curing the liquid conductive epoxy to form a conductive adhesive connection between the first node and the second node.

14. The method of claim 13 wherein the liquid epoxy mixture is formed by combining the first and second liquids with a third liquid, the third liquid comprising the ionic salt.

1 15. The method of claim 13 wherein the liquid epoxy mixture
2 is formed by combining the first and second liquids with a third liquid,
3 the third liquid comprising the ionic salt; and wherein the first, second
4 and third liquids are mixed prior to providing the liquid conductive
5 epoxy mixture between the first and second nodes.
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7 16. The method of claim 13 wherein the first and second liquids
8 are mixed prior to providing the liquid conductive epoxy mixture
9 between the first and second nodes.
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11 17. The method of claim 13 wherein the ionic salt is comprised
12 by the first liquid before combining the first and second liquids.
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14 18. The method of claim 13 wherein the ionic salt is comprised
15 by the second liquid before combining the first and second liquids.
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17 19. The method of claim 13 wherein the ionic salt is comprised
18 by the first and second liquids before combining the first and second
19 liquids.
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1 20. The method of claim 13 wherein the ionic salt comprises
2 a lithium salt.

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4 21. The method of claim 13 wherein the ionic salt comprises
5 a lithium imide salt.

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7 22. A method of forming a conductive adhesive connection
8 comprising:

9 providing a first node;

10 providing a second node;

11 providing a liquid conductive epoxy mixture between the first and
12 second nodes, the liquid conductive epoxy mixture comprising a first
13 liquid and a second liquid, the first liquid comprising a hardener and
14 the second liquid comprising a base epoxy; the liquid conductive epoxy
15 mixture comprising at least one ionic salt; the ionic salt being present
16 in sufficient concentration that a 15 mil length sample of the liquid
17 conductive epoxy mixture having cross-sectional dimensions of 50 mil
18 by 2 mil would have a resistance of less than about 100 ohms along
19 its length while having a viscosity of less than about 100,000 cps; and
20 curing the liquid conductive epoxy to form a conductive adhesive
21 connection between the first node and the second node.
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1 23. A method of forming a conductive adhesive connection
2 comprising:

3 providing a first node;

4 providing a second node;

5 providing a liquid conductive epoxy mixture between the first and
6 second nodes, the liquid conductive epoxy mixture comprising a first
7 liquid and a second liquid, the first liquid comprising a hardener and
8 the second liquid comprising a base epoxy; the liquid conductive epoxy
9 mixture comprising an ionic salt; and

10 curing the liquid conductive epoxy to form a conductive adhesive
11 connection between the first node and the second node.
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13 24. The method of claim 23 wherein the liquid epoxy mixture
14 is formed by combining the first and second liquids with a third liquid,
15 the third liquid comprising the ionic salt.
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17 25. The method of claim 24 wherein the ionic salt is completely
18 dissolved in the third liquid prior to combining the third liquid with the
19 first and second liquids.
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1 26. The method of claim 23 wherein the liquid epoxy mixture
2 is formed by combining the first and second liquids with a third liquid,
3 the third liquid comprising a thinner selected from the group consisting
4 of aliphatic glycidyl ethers and aromatic glycidyl ethers, the ionic salt
5 being a lithium salt present in the third liquid to a concentration of
6 from about 0.5 molar to about 1.2 molar prior to combining the third
7 liquid with the first and second liquids.

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9 27. The method of claim 23 wherein the ionic salt comprises
10 a lithium imide salt.

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12 28. The method of claim 23 wherein the ionic salt comprises
13 one or more salts selected from the group consisting of LiAsF_6 and
14 $\text{LiN}(\text{CF}_3\text{SO}_2)_2$.
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1 29. A method of forming a conductive adhesive connection
2 comprising:
3 providing a substrate, the substrate having a first node location
4 and a second node location, the first and second node locations being
5 joined by an electrical interconnect;
6 providing a first component having a first node;
7 providing a second component having a second node;
8 providing a liquid conductive epoxy between the first node and
9 the first node location, the liquid conductive epoxy comprising a first
10 liquid and a second liquid, the first liquid comprising a hardener and
11 the second liquid comprising a base epoxy; the liquid conductive epoxy
12 comprising a lithium salt;
13 providing the liquid conductive epoxy between the second node
14 and the second node location; and
15 curing the liquid conductive epoxy to form a circuit comprising the
16 first component electrically connected to the second component.
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30. A method of forming a circuit comprising:

providing a substrate, the substrate having a first node location and a second node location, the first and second node locations being joined by an electrical interconnect;

providing a first component, the first component having a first node;

providing a second component, the second component having a second node;

providing a liquid conductive epoxy between the first node and the first node location, the liquid conductive epoxy having sufficient conductivity that a 15 mil length sample of the liquid conductive epoxy having cross-sectional dimensions of 50 mil by 2 mil would have a resistance of less than about 100 ohms along its length while having a viscosity of less than about 100,000 cps;

providing the liquid conductive epoxy between the second node and the second node location; and

curing the liquid conductive epoxy to form a circuit comprising the first component electrically connected to the second component.

1 31. A method of forming a circuit comprising:
2 providing a substrate, the substrate having a first node location
3 and a second node location, the first and second node locations being
4 joined by an electrical interconnect;
5 providing a first component, the first component having a first
6 node;
7 providing a second component, the second component having a
8 second node;
9 providing a liquid conductive epoxy mixture between the first node
10 and the first node location, the liquid conductive epoxy mixture
11 comprising a first liquid and a second liquid, the first liquid comprising
12 a hardener and the second liquid comprising a base epoxy; the liquid
13 conductive epoxy mixture comprising at least one ionic salt, the mixture
14 having a sufficiently high ionic salt concentration that a 15 mil length
15 sample of the liquid conductive epoxy mixture having cross-sectional
16 dimensions of 50 mil by 2 mil would have a resistance of less than
17 about 100 ohms along its length in less than or equal to about 30
18 minutes of combining the first and second liquids;
19 providing the liquid conductive epoxy mixture between the second
20 node and the second node location; and
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1 curing the liquid conductive epoxy to form a circuit comprising the
2 first component electrically connected to the second component.
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4 32. The method of claim 31 wherein one of the first and
5 second components is a battery and the other of the first and second
6 components is an integrated chip.
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8 33. An epoxy comprising:
9 a liquid mixture of a hardener and a base epoxy; and
10 a concentration of an ionic salt within the liquid mixture, the
11 concentration of the ionic salt being high enough that a 15 mil length
12 sample of the liquid mixture having cross-sectional dimensions of 50 mil
13 by 2 mil would have a resistance of less than about 100 ohms along
14 its length in less than or equal to about 30 minutes of forming the
15 liquid mixture.
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1 34. An epoxy comprising:
2 a liquid mixture of a hardener and a base epoxy; and
3 a concentration of ionic salt within the mixture, the concentration
4 of ionic salt being high enough that a 15 mil length sample of the
5 liquid mixture having cross-sectional dimensions of 50 mil by 2 mil and
6 a viscosity of less than 100,000 cps would have a resistance of less than
about 100 ohms along its length.

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9 35. An epoxy comprising a lithium salt.

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11 36. The epoxy of claim 35 wherein a 15 mil length sample of
12 the epoxy having cross-sectional dimensions of 50 mil by 2 mil has a
13 resistance of less than about 100 ohms along its length.

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15 37. An epoxy comprising:
16 a liquid mixture of a hardener and a base epoxy; and
17 a concentration of a lithium salt within the liquid mixture.

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19 38. The epoxy of claim 37 wherein the lithium salt comprises
20 lithium imide salt.
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1 39. The epoxy of claim 37 wherein the lithium salt comprises
2 one or more salts selected from the group consisting of LiAsF_6 and
3 $\text{LiN}(\text{CF}_3\text{SO}_2)_2$.

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5 40. An epoxy system comprising:
6 a first liquid comprising a hardener;
7 a second liquid comprising a base epoxy; and
8 a third liquid comprising a concentration of a lithium salt, the
9 first, second and third liquids being configured to be mixed together to
10 form a liquid epoxy which will cure to form a conductive adhesive
11 bond.

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13 41. The epoxy system of claim 40 wherein the lithium salt
14 comprises lithium imide salt.

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16 42. The epoxy system of claim 40 wherein the lithium salt
17 comprises one or more salts selected from the group consisting of
18 LiAsF_6 and $\text{LiN}(\text{CF}_3\text{SO}_2)_2$.

43. The epoxy system of claim 40 wherein the third liquid comprises a thinner selected from the group consisting of aliphatic glycidyl ethers and aromatic glycidyl ethers, the lithium salt being present in the third liquid to a concentration of from about 0.5 molar to about 1.2 molar.

44. An epoxy comprising:
a liquid mixture of a hardener and a base epoxy; and
a concentration of ionic salt within the mixture, the concentration of ionic salt being high enough that a 15 mil length sample of the liquid mixture having cross-sectional dimensions of .50 mil by 2 mil and a viscosity of less than 100,000 cps would have a resistance of less than about 100 ohms along its length in less than or equal to about 30 minutes of forming the liquid mixture.

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